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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/966,812	09/28/2001	Charles M. Lieber	HUV-039.01	3072

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EXAMINER

LISH, PETER J

ART UNIT PAPER NUMBER

1754

DATE MAILED: 02/10/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/966,812

Applicant(s)

LIEBER ET AL.

Examiner

Peter J Lish

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 March 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-25 and 27-29 is/are rejected.
- 7) ☒ Claim(s) 26 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5,6,8,9.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: irradiated mail notice

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 6-9, 11, 14-16, 18-19, and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Dai et al. (USPN 6,401,526).

Dai et al. disclose a process for producing nanotube tips by applying a metallic catalyst to a tip assembly and growing a carbon nanotube(s) over the catalyst. The tip assembly includes an array of silicon pyramidal tips, or multifaceted probes, integrated onto commercially available AFM cantilevers (column 4, lines 58-61 and Figure 2). The catalyst is applied to the tips by contacting the tip with a liquid catalyst precursor. The liquid precursor comprises a metal-containing salt, such as chlorides, nitrates, or sulfates, a long-chain molecular compound, and a solvent, such as an alcohol. The use of iron salts is taught, as is the use of methanol (column 4, lines 1-20).

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The nanotubes grown using the process of Dai et al. include individual SWNTs and bundles of SWNTs (column 6, lines 1-5). Dai et al. also disclose a process for shortening the as-grown carbon nanotube tips by electric etching (column 7).

Claims 1, 17 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Hafner et al. ("Growth of nanotubes for probe microscopy tips").

Hafner et al. disclose a technique for growing individual carbon nanotube probe tips by chemical vapor deposition, using ethylene, from the ends of silicon tips. The nanotubes grown by the process of Hafner et al. are MWNTs.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 12 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al.

Dai et al. is applied as above. Dai et al. teach the use of iron as the metal as well as the use of nitrate as the salt. It therefore would have been obvious to one of ordinary skill at the time of invention to use iron nitrate as the metallic salt component of the catalyst precursor.

Dai et al. teach an electric etching nanotube shortening process. The SWNT is brought into contact with a heavily doped silicon substrate. A voltage is applied between the tube and

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substrate and gradually increased until the loss of tube-substrate contact occurs as a result of nanotube shortening. This allows the lengths of SWNTs to be reduced in steps of about 30 nm (column 7, lines 43-52). It is also taught that the SWNTs are typically shortened from a length of 1-20 microns down to 30-100 nm. It therefore would have been obvious to one of ordinary skill at the time of invention to perform multiple shortening steps by using a pulsed technique in order to reach nanotubes of a desired length.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. as applied to claim 1-3 above, and further in view of Kong et al. ("Synthesis of individual single-walled...").

Dai et al. do not teach the application of a mask to the tip assembly. However, Dai et al. does teach numerous methods for controlling the application of the catalyst precursor liquid such as a stamping method and special tower-tip forms (column 6). Kong et al. teach a method of controlling the application of a catalyst precursor liquid by the use of removable masks of polymer, specifically PMMA (Figure 1). It would have been obvious to one of ordinary skill at the time of invention to use the masks of Kong et al. on the process of Dai et al. in order to control the application of the catalyst precursor liquid.

Claims 10 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. as applied to claims 1 and 8 above, and further in view of Ago et al. ("Dispersion of metal nanoparticles for aligned carbon nanotube arrays").

Dai et al. teach the use of catalyst liquid precursors. They do not specifically teach the use of metal colloid suspensions. However, it is taught that the liquid precursors lead to a

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material containing finely dispersed metal oxide catalytic nanoparticles which serve as active sites for SWNT synthesis. Ago et al. disclose the use of metal colloid suspensions, specifically using a cobalt metal, for the dispersion of catalytic nanoparticles which serve as active sites for SWNT synthesis. It would have been obvious to one of ordinary skill at the time of invention to use a metal colloid suspension as the catalyst precursor liquid of Dai et al. in order to produce finely dispersed catalytic nanoparticles for SWNT growth. It would also have been obvious to one of ordinary skill to replace the cobalt metal colloid of Ago with an iron colloid, because finely dispersed iron and cobalt nanoparticles are equivalents concerning their ability to catalyze SWNT growth.

Claims 25 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boggild (USPGPub 2002/0061662 A1).

Boggild discloses a method of producing nano-tweezers by applying 2 or more individual electrodes to a tip assembly and applying a tip element to 2 of the electrodes. In a preferred embodiment, at least one of the tip elements is a carbon nanotube (paragraph [0113]).

It would have been obvious to one of ordinary skill at the time of invention to use two tips made of carbon nanotube(s). Boggild does not specify what type of nanotube structure is preferred (SWNT or MWNT), however it would also have been obvious to one of ordinary skill at the time of invention to use either SWNTs or MWNTs in the process of Boggild, as they both fulfill the desired properties.

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Allowable Subject Matter

Claim 26 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 703-308-1772. The examiner can normally be reached on 9:00-6:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 703-308-3837. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-305-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

PL
January 28, 2003



STUART L. HENDRICKSON
PRIMARY EXAMINER